We thank the reviewers for the valuable comments and suggestions. The replies to each comment are given below (marked in blue).

Referee #1:

In the revised version of this manuscript, the authors took care to solve all the comments and did a good job implementing the other reviewer and my reviews. As a result, the introduction and the presentation of the analogue models improved substantially and strengthened the analytical approach. I still have some minor comments based on the newly added sections and especially the meaning of the return flow ratio Fr. If these comments are resolved, this manuscript is suitable for publication in Solid Earth.

- We sincerely thank Referee #1 for reviewing the revised version of our manuscript, providing valuable comments. We have incorporated each of these suggestions in the current revised version.

Minor comments:

1. As far as I understood, the return flow ratio Fr takes into account both burial/exhumation plus the effect of squeezing/unsqueezing of the accretionary wedge. So, a sentence or two should be added near Line 240 to clarify this parameter. This would avoid my initial confusion and help the readers to understand that Fr>>1 does not imply that more material is being exhumed than subducted and is due to the extrusion of the wedge. This should be reminded in parts of the discussions (e.g., in section 5.1, line 510)

- We greatly appreciate these excellent suggestions. The return flux ($F_r$) is now defined clarifying that this parameter takes into account both burial/exhumation and the effect of squeezing (or unsqueezing) of the wedge, as suggested by the reviewer (Lines 240-242). We also clarify this implication of $F_r$ later in the discussion section (Lines 485-486). Thanks for this comment.

2. When the authors compare exhumation rates between their models and nature, they should use an appropriate scaling for the velocity. In Line 536, U=3 cm/yr is used to calculate exhumation rates between 4-7 mm/yr (U/4 to U/8) but oceanic plates are much faster (2 to even 4 times faster in some plate reconstructions). Therefore, I recommend using plate velocities appropriate for the tectonic setting being compared.

- We appreciate this insightful comment and suggestion by the reviewer. Subduction velocities can vary from 1-2 cm/yr to >10 cm/yr. However, in our analytical solution, U is taken as the velocity at the base of the accretionary wedge (Lines 130-132), and is essentially a kinematic boundary condition. In natural subduction zones, part of the subducting velocity can be accommodated along a fault between the base of the wedge and the subducting plate. Consequently, U can be equal or considerably less in magnitudes than the subduction velocities. In the present revised version, we modify the sentence, considering the maximum vertical uplift velocities ($v_{max}$) in a non-dimensional form (normalized to U) (Lines 544-545).

3. In the analogue models, section 5.1 and especially Fig 10b, how realistic are the OP-wedge viscosity ratios and the scaled wedge viscosity (5e20 Pa*s; line 387) compared to estimates through power-laws? A more in-depth comparison is missing here, the composition, thermal structure and deformation mechanisms of the overriding plate (oceanic or continental) and the accretionary wedge provide clues on the plausible range of viscosity ratios for different settings, which ultimately impact the conditions for return flows. Also, is it realistic to consider viscosity ratios < 1?

- We acknowledge these important points raised by the reviewer. Fig. 10b shows an analytically determined plot of the return flux ($F_R$) as a function of overriding plate-wedge viscosity ratio, ranging from 1 to $10^4$. It means that, for a given wedge viscosity (~$10^{19}$-$10^{20}$ Pa s), our model accounts for two extremities- a very weak (viscosity ~$10^{19}$-$10^{20}$ Pa s) to an extremely strong (~$10^{23}$-$10^{24}$ Pa s) overriding plate condition. The reviewer has correctly pointed out that the strength of the overriding plate depends on the composition, thermal structure and deformation mechanisms. In this revised version, we address this issue in the discussion section (Lines 271-276).

The scaled viscosity in the analog models (i.e., 5$e^{20}$ Pa s) is relatively higher, as mentioned in the earlier version (Line 393 in the current version). We have shown from the analytical models that it is not the absolute viscosity, but the OP-wedge viscosity ratio ($\mu_r$) is the main factor in determining the corner flow kinematics. However, the absolute viscosity magnitude becomes an important parameter in controlling the gravity-driven flow intensity during later stages of wedge deformation. This aspect of our modelling is discussed in this version (Lines 393-396). Thanks for this excellent suggestion.

In natural settings, hydrated metasedimentary wedges are generally weaker (i.e., lower viscosities) than the overriding crustal counterparts. Our entire analysis thus considers conditions of $\mu_r \geq 1$ in Fig. 10b.

Line to line comments:
Line 20: delete 'the' in 'the subduction'

- Deleted.
Line 28: add 'the' to 'the Earth's…'

- Added.
Line 28: 'in course of the convergence movements' this sentence could be replaced with 'during active subduction'

-Sentence modified.
Line 50: remove 'the' from 'the accretionary wedge'

-Removed.
Line 84: 'Subduction' to 'subduction'

-It’s written as ‘subduction’ in the revised version.
Lines 87-88: Here I recommend just describing it as a non-parallel component on the slab velocity, just like it was said in lines 122-123.

-The sentence is modified.
Lines 116-117: Rewrite this sentence, as rocks deform but flow in a solid-state manner rather than being a fluid, and the viscosity is an approximation to replicate such deformation.

-We appreciate this comment. The sentence has been rewritten accordingly.

Lines 239-240: In this sentence I recommend including that the return flux Fr is the ratio of material being returned and the effect of squeezing the wedge to the material being buried plus the ‘unsqueeze’ of the wedge

-The sentence is modified (Lines 240-242).
Line 363: typo ‘configuration’

-Corrected.
Line 379: remove ‘The’

-Removed.
Line 471: here I recommend including what each parameter mean: slab advance/rollback, high viscosity contrasts, etc.

-Sentence is modified. Thanks for the suggestion.
Line 483: I would change the word ‘explains’ to ‘predicts’ as there are not natural examples mentioned in the text

-Sentence modified.
Line 490: ‘characteristics’ to ‘processes’

-Changed.
Line 501: Only the viscosity of the overriding plate or also the wedge?

-Return flux is dependent on the viscosity ratio between the overriding plate and the wedge. The sentence is modified.
Lines 521-523: Here I would reconsider mentioning subduction erosion as a process since it is mostly linked to the removal of the base of the overriding plate and not the same as sediment subduction, which I think is what the authors mean in this sentence. In addition, subduction erosion is facilitated in sediment starved margins and therefore not applicable in the context of accretionary wedges.

-The term is removed in the revised version.
Line 576: typo ‘horizontal’

-Corrected.

Referee #2:

In the revised manuscript and the authors' response, the authors have adequately addressed my previous comments. A key strength of the manuscript is the comparison between analytical solutions and results from analogue experiments for corner flow involving a deformable overriding plate and subduction velocities that are not necessarily parallel to the wedge base. However, the specific model geometry, the required strength contrast between the wedge and the overriding plate, and the omission of buoyancy and thermal evolution still make it difficult to assess the significance of the proposed forced return flow for natural rock exhumation. Nevertheless, the study contributes to an improved understanding of forced return flow under a range of corner-flow configurations.

-We greatly appreciate the reviewer for the valuable comments on revised version of the manuscript. Our analytical (mechanical) models simplify the natural convergent settings to show the crustal flow patterns within a wedge as a function of wedge configuration and the kinematic boundary conditions. This analytical study focuses on the wedge flow kinematics at crustal levels <40 km, assuming that the density difference between the wedge metasediments and their ambient materials and thereby the effect of effective buoyancy is relatively much weaker than the effect of downward basal motion. In such a scenario, the dynamic-pressure driven flow becomes important, as considered in this study. Nevertheless, positive buoyancy of wedge materials can act as an additional factor in amplifying the exhumation process. Omission of this buoyancy parameter is thus a limitation in this study, which has been mentioned in several sections of the manuscript (Lines 495-497, 563-564).

I have a few minor comments that the authors may wish to consider:
Line 77: It could also be stated here that buoyancy is explicitly excluded from the model.

-The sentence is modified in the revised version (Line 77).
Lines 236–238: This sentence and the cited references are potentially misleading. In the studies by Agard et al. (2009) and Yamato et al. (2007), buoyancy plays a fundamental role in driving return flow. In contrast, the present study investigates forced return flow in the absence of buoyancy. In my view, the studies of Agard et al. (2009) and Yamato et al. (2007) do not support return flow without buoyancy, but rather argue for buoyancy as the dominant mechanism controlling return flow (see, for example, Fig. 13 in Agard et al., 2009, and Fig. 11d in Yamato et al., 2007).

-We greatly appreciate this discussion by the reviewer. We would like to mention that both the studies by Agard et al. (2009) and Yamato et al. (2007) show a difference in the exhumation characteristics between accretionary wedge metasediments and oceanic crustal units. These studies highlight the importance of corner flow processes in the circulation of wedge metasediments (Fig. 8 in Yamato et al., 2007), whereas the exhumation of oceanic crustal units (Fig. 13 in Agard et al., 2009, Fig. 11d in Yamato et al., 2007) occurs due to the buoyancy effects of a thick low-density, low-viscosity serpentinite layer below the oceanic crust. For a relatively low density contrast between the wedge metasediments and the ambient, as expected in the crustal level (<40 km), the corner flow-driven exhumation process is expected to be a dominate mechanism in wedges. Such exhumation can, however, be strengthened due to additional effects of positive buoyancy (discussed in Lines 495-497, 563-564).

Section 5.2: Regarding the Western Alps, the study by Vaughan-Hammon et al. (2022, Geochemistry, Geophysics, Geosystems) could be cited. That study models syn-convergent burial–exhumation cycles and produces pressure–temperature paths and metamorphic facies gradients that agree, to first order, with observations from exhumed rocks in the Western Alps.

- The reference is added in Line 29, and Line 506. Thanks for this valuable suggestion.